Abundance, Upstream Migration, Age-Composition and Fecundity of Hobiton Lake Adult Sockeye *(Oncorhynchus nerka)*, 1982

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ABUNDANCE, UPSTREAM MIGRATION, AGE-COMPOSITION AND FECUNDITY OF HOBITON LAKE ADULT SOCKEYE SALMON (Oncorhynchus nerka), 1982

by

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ABSTRACT

Manzer, J. I., M. Wright, I. Miki, and K. D. Hyatt. 1983. Abundance, upstream migration, age-composition and fecundity of Hobiton Lake adult sockeye salmon (Oncorhynchus nerka), 1982. Can. Tech. Rep. Fish. Aquat. Sci. 1262: iv + 57 p.

The sockeye run to Hobiton Lake in 1982 was monitored during 14 May-26 July. The total run was estimated to be 76,320 pieces, of which 26,881 were caught by the native fishery and 49,439 entered the lake to spawn. Approximately 60% of the run occurred in June. Fluctuations in the daily escapement were examined in relation to daily catch, temperatures and water levels for the Hobiton River, and mean barometric pressures for the area, using multiple regression analysis. A significant relationship was found only between escapement and barometric pressure. Migration upstream was mainly nocturnal with 80% of the sockeye moving during 2200 and 0600 h. Five age types (1.1, 1.2, 1.3, 2.2, and 2.3) comprised the run, but 1.2s and 1.3s predominated (72.3 and 23.1%, respectively). Males were slightly more numerous than females (53 to 47%). Average egg number by count for 1.2 and 1.3 females was 2428 (SD=304) and 2949 (SD=428), respectively. Potential egg deposition by females was estimated to be 59.4×10^6.

RÉSUMÉ

Manzer, J. I., M. Wright, I. Miki, and K. D. Hyatt. 1983. Abundance, upstream migration, age-composition and fecundity of Hobiton Lake adult sockeye salmon (Oncorhynchus nerka), 1982. Can. Tech. Rep. Fish. Aquat. Sci. 1262: iv + 57 p.

Le présent rapport porte sur la remonte du saumon rouge vers le lac Hobiton, surveillée du 14 mai au 26 juillet 1982. On a évalué la remonte totale à 76,320 poissons dont 26,881 ont été capturés par les pêcheurs autochtones et 49,439 se sont rendus jusqu'au lac pour frayer. Environ 60% de da remonte s'est effectuée en juin. À l'aide d'une analyse de régression multiple, on a étudié les fluctuations de la remonte quotidienne par rapport à la prise, à la température et aux niveaux de l'eau enregistrés chaque jour dans la rivière Hobiton ainsi qu'à la pression barométrique moyenne de la région. Une relation significative n'a été découverte qu'entre la remonte et la pression barométrique. La migration vers l'amont se produisait principalement la nuit, 80% des saumons rouges se déplaçant entre 22 h et 6 h. La remonte regroupait cinq groupes d'âge (1,1, 1,2, 1,3, 2,2, et 2,3) mais les types 1,2 et 1,3 étaient plus abondantes (72,3 et 23,1% respectivement). Les mâles étaient légèrement plus nombreux que les femelles (53% v. 47%). Le nombre moyen d'oeufs par numération pour les femelles 1,2 et 1,3 totalisaient 2,428 (É.-T.=304) et 2,949 (É.-T.=428) respectivement. On a évalué la ponte potentielle à 59,4 x 10^6 oeufs.

INTRODUCTION

Hobiton Lake produces virtually all the sockeye salmon (Oncorhynchus nerka) in the Nitinat Lake watershed. The stock supported a small commercial fishery during 1927-1957 (Kasmer, unpublished report made available by Dept. of Fisheries and Oceans, Port Alberni, B.C.) and a native food net fishery which has been carried out annually, mainly in areas adjacent to the mouth of Hobiton River. Published annual catch and escapement data for the period 1951-1977 indicate that Hobiton sockeye were most abundant during the early 1950's when total runs were estimated to be between 30-50,000 sockeye (Fedorenko et al. 1979). By the mid-50's abundance levels declined drastically which resulted in prohibition of the commercial fishery in 1958. The native food fishery has continued annually without interruption. During the 1970's the total runs were estimated by Department of Fisheries personnel to be between 2-10 thousand sockeye. Recent analyses of available information on native catches and sockeye escapements to Hobiton Lake suggest that these estimates probably are conservative (Hyatt, unpublished data). Nevertheless, it is obvious the stock is relatively small.

In 1977, as part of the Federal-Provincial Salmonid Enhancement Program (SEP), the Lake Enrichment Section of the Pacific Biological Station expanded its investigation on the effects of controlled enrichment of ultraoligotrophic sockeye salmon nursery lakes on sockeye salmon production. Six lakes in coastal British Columbia varying in physiochemical characteristics and trophic status were selected for treatment and study. Hobiton Lake was included in this group and annually from late spring to early fall since 1977 has received controlled additions of inorganic nitrogen and phosphorous (Stephens and Stockner 1983). Some results of controlled enrichment on primary and secondary production for Hobiton Lake have been included in reports by Rankin et al. (1979), Stockner et al. (1980) and Shortreed and Stockner (1981).

Virtually all Hobiton Lake sockeye spend one complete year in the lake and return as adults after 1, 2, or 3 winters in the ocean. Therefore, adults returning to Hobiton Lake in 1980 and subsequent years are progeny of treated brood years. Estimates of total runs in 1980 and 1981 suggest that some stock rehabilitation in association with lake enrichment has occurred (Manzer, unpublished data). The purpose of this report is to present information on stock size, upstream migrations and observed biological characteristics of the adult sockeye run to Hobiton Lake in 1982. In addition some attempt is made to examine the relationships between daily fluctuations in sockeye abundance and certain physical environmental variables.

DESCRIPTION OF THE STUDY AREA

The study was principally carried out on the Hobiton River. Hobiton River is approximately 1.5 km long, ranges from 15 to 50 m in width, and drains Hobiton Lake watershed, on the southwest coast of Vancouver Island, by flowing northeast (>1% gradient) into Nitinat Lake (Fig. 1). Hobiton River

water levels fluctuate greatly seasonally and are strongly influenced by the high annual precipitation (>250 cm) which occurs mainly as rain during October through March. Tidal fluctuations in Nitinat lake also affect water levels for a distance of approximately 100 m upstream from the river mouth. A natural holding pool for salmon is located approximately 0.5 km upstream from Nitinat Lake, and 100 m downstream from an installed salmon weir, the main working site for this investigation.

METHODS AND MATERIAL

INDIAN FOOD FISHERY

The Indian food fishery for sockeye in Nitinat Lake historically has been conducted by native fishermen under permit issued by the Department of Fisheries and Oceans. The fishery primarily takes place at or near the mouth of the Hobiton River. In 1982, for the first time, the fishery was conducted under a fishing by-law proposed by the Nitinaht Band Council and put into effect following consultation between personnel of the Department of Indian and Northern Affairs and Department of Fisheries and Oceans in Ottawa. The by-laws included several provisions concerning the catching, selling and conservation of sockeye salmon in Nitinat Lake, and are summarized in Appendix table 1. Participation in the fishery was limited to Nitinaht Band members.

Fishing began in late March and continued until the end of July. From 14 May to 24 July fishing was conducted daily, except on 12 intermittent days. From 1 to 4 gillnets were used throughout this period and were augmented by community drag seines beginning on 29 June. Information on catch by each gear type when both gears were used is not available.

The gillnets were constructed from nylon webbing of 4-1/4"-4-1/2" (10.8-11.4 cm) stretched measure, and measured approximately 25 fathoms (45 m) in length and 6 m in depth. Usually a gillnet was handled by 2 natives. On occasion 2 nets were joined at the ends to increase fishing capacity of the gear. Drag seines were of 2 sizes. The larger seine was 90 m long and 6 m deep; the smaller, 45 m long and 2.7 m deep. The mesh size ranged from 2-1/2"-3" (65-75 mm), stretched measure.

Information on size of catch by individual native fishermen was mainly obtained through personal interviews conducted daily by field personnel throughout the fishery. When it was known that a fisherman was not contacted the size of his catch could usually be obtained from the Nitinaht Band office. These measures are believed to have resulted in acquisition of very reliable data on the native fishery.

BIOLOGICAL SAMPLING

Catches made by native fishermen were sampled from 17 May to 12 July. Until June samples were taken at 2 to 3 day intervals but thereafter were taken approximately weekly. Fourteen samples ranging in number from 27 to 100 sockeye and totalling 996 fish were collected (Table 1). Nine of these samples represented gillnet catches; 5 samples represented community drag seine catches. Information on gear influence on catch characteristics was obtained from catches made by the two types of gear on successive days on two occasions (7 and 8 June, 13 and 14 June).

Individual sockeye in the samples were examined in the field for postorbital-hypural (PO-H.L.) length and sex. Several scales and both otoliths, if possible, were obtained from each sockeye sampled for age determination. The scales were removed from an area below the insertion of the dorsal fin mid-way between the dorsal fin and lateral line. Scales and otoliths were preserved in vials containing 50% glycerin solution bufferred with thymol crystals, and appropriately labelled to enable collation with age and sex data for individual sockeye. Age of sockeye was subsequently determined in the laboratory in accordance with methods described by Bilton (1970) for scales and Manzer (1976) for otoliths. The use of otoliths of sockeye to determine age has been discussed by Kim and Roberson (1968).

Information on fecundity was obtained by removing ovaries from females of varying length in the catches. The ovaries were placed in cotton bags appropriately labelled for individual identification, and preserved in 10% formaldehyde solution for subsequent processing and egg counting in the laboratory.

ESTIMATION OF ESCAPEMENTS

Most sockeye returning to Hobiton Lake in 1982 were enumerated by an electronic adult salmon counter (Model 289) manufactured by Pulsar Electronics Ltd., North Vancouver, B.C. The counter tunnels were installed in an adult salmon weir constructed across the Hobiton River approximately 0.5 km upstream from the mouth. In design the weir, 19.5 m long and 2 m high, was a modified "broomstick" weir with aluminum conduit spaced 1" (2.5 cm) apart, replacing conventionally used wooden dowling (Fig. 2). The weir was installed on 10 May and was removed on 4 August.

The principle of operation of the Pulsar fish counter has been described in some detail by Cousens (1982). Briefly, the counter is water conductivity sensitive and consists of 2 major components, namely 2 horizontal banks of 4 modular plastic tunnels (60 cm X 15 cm X 7.6 cm) through which upstream migrating salmon must pass, and a programmable tunnel monitor with print-out capability. The counter was powered by a 12v battery. Individual salmon passing upstream through a particular tunnel increased the conductivity in that tunnel in relation to water conductivity in an impassable conductivity reference tunnel. The difference in conductivity levels between the open and reference tunnels was detected by tunnel electrodes. Frequency of tunnel

conductivity differences was recorded by the monitor on paper tape according to selected time periods, usually one-hour intervals. The counter was installed on 14 May and, except from 2000 h, 27 June to 2200 h, 30 June when removed for repairs, operated continuously until 1100 h, 24 July. During counter removal all tunnels were blocked to prevent sockeye from migrating upstream, except for short periods when fish were allowed to pass through the tunnels and were counted visually. Sensitivity of the counter was maintained at a uniform level from installation to 23 June but on 24 June was increased and sensitivity remained unaltered at this higher level for the remainder of the period of installation. Except when the counter was removed the number of migrating sockeye was recorded for each hour but 0401 - 0500 on 19 and 21 May (Appendix table 3).

Accuracy of machine counts was determined by comparing simultaneous machine and visual counts, the latter recorded on hand tallies. A total of 49 checks was made on 20 days from 17 May to 3 July (Table 2). Most checks were made during early morning hours. The checking periods ranged in continuity from 37 min (21 June) to 8 h (12 - 13 June) (Appendix table 2). White flashboards were secured to the river bottom at tunnel exits to facilitate visual counting of sockeye as they proceeded upstream through the tunnels.

Passage of small sockeye through the aluminum pickets was also determined on 23 May and 15, 24, 25, 26 June to adjust the escapement for "by-pass". On 27 June chicken-wire was installed on the lower 0.6 m of the fence to prevent by-pass and to guide sockeye upstream through tunnels.

Machine error was determined by linear regression analysis. Visual counts, assumed to have no error, were used as the independent variable and machine counts were the dependant variable. Counts for less than one hour were adjusted to one hour. Data sets for periods when the counter operated under low and high sensitivity modes were examined separately. For each sensitivity mode, individual hourly machine counts were adjusted for error and summed to give corrected daily totals. Daily counts were further adjusted for "by-pass", when appropriate.

Adjusted hourly counts were used to determine diel movement of sockeye. Diel patterns were examined for days when the fishery did not operate, and for groups of days when the catch was <25, 25 - 50, 51 - 75, and >75% of the daily total run (catch plus escapement). Hourly percentages of the total daily run were transformed to arcsine values prior to analysis to minimize the deviation of low and high values from normality.

ENVIRONMENTAL OBSERVATIONS

Water levels and river temperatures were recorded daily from 14 May to 28 July, except for a few days during the latter part of the season. Water levels were read from a staff gauge graduated in cm, and located 5 m downstream from the counting weir. River temperatures were obtained at the weir site by reading a pocket thermometer immersed by hand.

Weather at the Hobiton weir was observed but recorded in general terms too imprecise to permit quantitative assessment of the impact on the numbers of upstream migrants. Alternatively an attempt was made to obtain information on weather from locations relatively close to the Hobiton River which presumably are reflective of the weather for the area. In this connection barometric pressure at Carnation Creek, 20 km from Hobiton River, was used. The barometric pressure data were obtained by a continuous recording Cassell barometer and daily means were based on readings for the even and half hours.

RESULTS

Catch: Sockeye were caught primarily at or near the mouth of Hobiton River. Small numbers of sockeye were also caught off Doobah Creek on the east shore of Nitinat Lake, and inside the Nitinat Narrows. Most if not all of the sockeye caught in these areas are considered to be of Hobiton Lake origin and therefore are included in the total catch figures.

According to members of the Nitinaht Band, sockeye in 1982 were first observed in Nitinat Lake during late March. From first observation until 13 May, 1400 sockeye were reportedly caught. Subsequently and until the fishery terminated on 26 July sockeye were caught on each day but 12 scattered throughout the season (Table 3). Statistics obtained from either native fishermen or band conservation officers show that daily catches fluctuated sharply (Fig. 3a). From 13 May to 12 June daily catches rarely exceeded 250 sockeye and averaged 184.3. After 12 June catches varied more in magnitude and on several days approximately 1500 sockeye were caught. The average daily catch for this period was 686.7 sockeye. Since fishing practices and quantity of gear were virtually unchanged from those used earlier, the larger catches presumably are due to an increase in the abundance of sockeye over this period of time. The largest catch for 2 consecutive days (3132) occurred on 29-30 June. Following mid-July and until 26 July when fishing ceased, catches returned to pre mid-June levels. The reported total catch for 1982 was 26,881 sockeye. In view of the great amount of effort devoted to collecting daily catch statistics and contacting individual fishermen it is believed that this estimate is very close to the actual catch.

Escapement: Simultaneous visual and machine counts of adult sockeye migrants for low and high machine sensitivity modes are given in Appendix table 2. Machine counts were less than visual counts in 26 of the 49 tests, and equal in the remaining 23 tests. The hypothesis that deviation from equality was independant of density was tested using the model $y=a\ x^b$, where y is the machine count, x is the visual count, and a and b are constants. Statistics summarizing the results of linear regression analysis of log transformed data for low and high sensitivity modes separately are presented in Table 4. The results indicate that for each mode the regression line deviated significantly from a line of equality, i.e. b=1. Thus, the hypothesis that machine error does not increase with increasing number of migrants is statistically rejected (Ho: b=1; low: $p=<0.001$, n=36; high: $p=<0.05$, n=13).

Unadjusted and adjusted hourly machine counts of sockeye migrants are given in Appendix tables 3 and 4, respectively. Adjusted values for low and high sensitivity modes were derived from the formula log y=loga+blogx. Included in Appendix table 4 are interpolated values (based on adjacent hours) when the machine failed to count between 0400 and 0500 h on 19 and 21 May, and visual hourly counts from 1900 h 27 June to 2200 h 30 June when the counter was removed. Adjusted hourly counts for each day from 14 May to 24 July are plotted in Fig. 4.

Daily fluctuations in the escapement of sockeye through the tunnels during 14 May to 24 July inclusive is illustrated in Figure 3b. Over this period migrating sockeye were observed on all but 5 days. Abundance levels were lowest during 30 May-11 June, thereafter increased intermittently and reached maximum numbers during late June and again during early July, after which time numbers decreased substantially. The largest number of migrants (adjusted counts) for a single 24-hr period occurred on 26 June (12,166), equalling 26.3% of the 46,282 sockeye recorded (Appendix table 4).

A relatively small number of sockeye moved through the weir between pickets, thus by-passing the counter and proceeding upstream unrecorded. Available data on sockeye by-pass are summarized in Table 5. According to observations on 5 days, fractions of the daily run not utilizing tunnels to achieve access upstream varied from 0.2% to 17.8%. Apparently daily by-pass was variable and not associated with either river water level or number of migrants. Assuming a mean by-pass rate of 2.3% prior to 26 June, and a 17.8% rate on 26 and 27 June prior to chicken-wire installation to curtail by-pass, it is estimated that 3157 sockeye escaped counting during the period the counter and weir were operating.

The escapement in 1982, adjusted for machine error and for "by-pass" amounted to 46,282 + 3157, respectively or 49,439 sockeye.

Influence of physical conditions on escapement: The escapement of sockeye into Hobiton Lake was examined in relation to the native fishery, water levels, and temperature of Hobiton River, and changes in weather for the area, as indicated by barometric pressure observations at Carnation Creek. Daily fluctuations in the escapement in relation to each of the enviromental factors over a period of 68 days between 14 May and 27 July are shown in Fig.5. Multiple regression analyses incorporating daily escapements as the dependent variable indicated that only 11.37% of the variance in the escapement could be explained by the native catch, level and temperature of Hobiton River, and the barometric pressure, collectively. Of this amount barometric pressures accounted for 11.35% through a significant inverse relationship at the 5% level (Table 6). Since increases in the escapement appeared to follow drops in pressure (Fig. 5) the relationship between barometric pressure and the escapement was examined in greater detail by introducing time lags of 0 to 4 days between the 2 variables. The relationship between escapement and each time interval was significantly correlated ($P=<0.01$) but the correlation coefficient was highest for a time lag of 2 days (Table 7).

Total run: The total run of Hobiton sockeye (catch plus escapement) in 1982 was 26,881 + 49,439 = 76,320. Daily fluctuations in the total run closely paralleled that observed for the escapement (Fig. 4). This is perhaps to be expected since only 35% of the total run was removed by the fishery. Completion of the total run by month was estimated to be 10% prior to June, 60% during June, and 30% following June. These estimates are approximate since a few sockeye migrated into Hobiton Lake prior to and following the study period.

Diel migration: Sockeye migration into Hobiton Lake was unimpeded by fishing activity or net-blockage of the river mouth on 7 days (16, 17, 23, 24 June, 18, 20, 22 July) from 14 May to 24 July. The estimated number of sockeye migrants on these days ranged from 34 to 4542 (Appendix Table 4) and for all days combined totalled 7400. This total represents 16.4% of the escapement counted electronically at the weir. The diel migration pattern for sockeye on uninterrupted or "normal" days was determined from these data using the formula

$$\bar{P} = \frac{1}{n} \sum_{j}^{n} P_{ij} \quad .$$

where $\bar{P}$ is the mean proportion of the daily migration for a given hour for all days combined when n = number of days
i = 1, 2,...24th hour
j = 1...nth day
Pij = proportion of run observed in hour i day j

The results of the calculations using arcsigned values are illustrated in Figure 6, panel (a), along with ±2 S. E. of the hourly mean. Apparently, Hobiton sockeye begin their movement upstream in late evening (2200 h) and continue their migration in relatively strong but variable numbers through to 0700 h. A minor surge in numbers was observed during 0900-1000 h. Thereafter and until 2200 h practically no sockeye migrated.

Using the above formula, mean diel patterns were obtained for groups of days when the native catches equalled <25, 25-50, 51-75, and >75% of the total run (catch + escapement) (Fig. 6, panels b - e). Statistics on the number of days and sockeye migrants in each data set for each quartile are presented in Table 8. Subjection of the data to the Kendall Coefficient of Concordance nonparametric test (Siegel, 1956) indicated that the agreement among diel patterns when sockeye were unimpeded in their upstream migration and when the fishery operated at different levels of intensity was highly significant ($W = 0.723$, $k = 5$, $N = 24$, $P = <0.001$). The most anomalous pattern was associated with days when catch did not exceed 25% of the daily run. This data set indicated the run was relatively weak during 0100-0200 h and stronger than the other groups during 1500-1800 h. This pattern can be regarded to be anomalous because of events on 12 June. On that day the river was blocked to upstream migrants until 0400 h, causing an increased proportion of the day's run of 12,166 sockeye (48.2% of the data set) to migrate during later hours.

Since the diel patterns for the various fishing levels did not differ significantly, all days (65) were combined to generate a grand diel migration pattern. The results are shown as hourly means (±2 SE) in Panel f of Figure 6. The number of migrants increased significantly following 2200 H and decreased significantly following 0600 h. During this approximate nocturnal period, on average, 80% of the sockeye migrated upstream, leaving the remaining 20% to migrate during 0700 and 2200 h (Table 9). A weak but significant positive relationship exists between the proportion of sockeye migrating during the daytime and the magnitude of the daily run ($n = 65$, $r = 0.36$, $p = <0.01$). The average cumulative percent of the daily run by hour for the different fishing levels as well as for all levels combined are plotted in Figure 7.

BIOLOGICAL CHARACTERISTICS

Size, age, and sex composition: Information on size distribution and age and sex compositions of sockeye was obtained from analyses of 14 samples of the native catches made between 17 May and 12 July. The sockeye were caught either by gillnet or community drag seine. A total of 996 sockeye were sampled, representing 3.7% of the catch and 1.3% of the estimated total run.

Information on bias of gillnets (GN) and drag-seine (DS) on size distribution of sockeye was obtained from 2 pairs of samples of catches made on succeeding days (June 7 and 8, June 13 and 14) by the two gear types. For the first set of samples the mean postorbital-hypural lengths of sockeye taken by gillnets was slightly larger than that taken by drag-seine, but the difference was not significant (GN: $\bar{L}$=422.6 mm, SE=2.46; DS:$\bar{L}$=419.9 mm, SE=2.86). Sockeye taken by gillnets in the other pair of samples also were larger but in contrast to the earlier pair of samples the mean lengths differed significantly (GN: $\bar{L}$=427.7 mm SE=2.77; DS:=$\bar{L}$=413.4 mm, SE=2.88). When the samples by each gear were pooled however, and mean lengths compared, using the 2-sample t test, no significant difference in length was detected ($t=0.2526$, $P>0.05$, $df=1, 387$). Consequently length data from overall catch were not adjusted for gear selectivity.

The mean size (±2SE) of sockeye in the individual samples from 17 May to 12 July is illustrated in Figure 8. The mean size of sockeye fluctuated to some extent through this period but size obviously declined. During late May the average postorbital-hypural length for sockeye was approximately 440 mm. By mid-July the mean length had declined to 413 mm.

The postorbital-hypural length distribution for sockeye of different age[1] and sex are shown in Figure 9 for combined samples. Considering the 2 dominant age-types, 1.2 and 1.3, no significant difference in mean length of males and females of these ages was observed. Comparing size by age, 1.2s were smaller than 1.3s by approximately 50 mm ($\bar{L}_{1.3}$= 456 mm, $\bar{L}_{1.2}$= 410 mm).

[1]Age is designated according to the European system. The first digit represents the number of annuli formed during freshwater residence; the second digit, the number of annuli formed during ocean residence.

Of the 966 sockeye in the 14 samples of the native fishery age was determined from scale impression or otolith readings for 973 individuals. The number of sockeye in individual samples ranged from 27 to 99. Changes in the age and sex composition of sockeye through the run, weighted for the season, are given in Table 10.

The percentages were calculated using the formula:

$$X = (r/R \times n/N)100$$

Where X = % of given age and sex
r = catch + escapement for sample period
R = total catch + total escapement
n = number of sockeye of particular age and sex in sample
N = sample size.

Information on age and sex composition was derived mainly from samples of the native fishery. If gear selection for size and therefore age occurred it is possible that this information may not be representative of the total run (catch and escapement). This is particularly true of age 1.1, or "jacks", which because of their smaller size (mean PO-HL = 304 mm) would not be caught by the gear used. Of the 996 sockeye sampled, 5 or 0.5% were jacks. However observations made at the weir on 12 days between 23 May and 3 July in the escapement suggests no substantial difference from observations on catch: of 8021 sockeye observed 84, or 1.0% were jacks (Table 11). Accordingly, it is believed that the data are useful in indicating the relative importance of the various age and sex groups to each other at different times through the run.

Sockeye of 5 age-types were present in the samples: 1.1, 1.2, 1.3, 2.2, and 2.3. Over the season, 1.2s were dominant (72.3%) followed by 1.3s (23.1%). Of the other 3 age-types 2.2s were most prominent (3.8%). The proportion of 1.2s and 1.3s varied considerably through the season. During mid-May the two age-types apparently were approximately equal in importance. Thereafter and until early June their relative importance differed by as much as approximately 30% with neither age-type being dominant. Following early June (7 June) 1.2s were consistently dominant, their contribution to the total run ranging from 68.4% (27 June) to 86.6% (12 July).

Over the season males were slightly more numerous than females, 53 and 47% respectively. However, on occasion one sex appeared to dominate. Marked disparities in sex ratios were observed on 25 May and 12 July in favour of females (71.4% and 68.0%, respectively) and on 2, 14, and 27 June in favour of males (approximately 65%).

Fecundity and Potential Egg Deposition

The relationship between egg number and postorbital-hypural length was examined for age 1.2 and age 1.3 females, using linear regression analysis (Fig. 10, Table 12). Other models of best fit were not determined in view of the rather limited size range and numbers of individuals in the samples of the 2 age-types: 25 age 1.2s ranged in length from 36.5 to 48.5 cm; 11 age 1.3s ranged in length from 44.5 to 49.0 cm. The largest age 1.2 sockeye was 5.5 cm larger than the next largest member of that age, and was almost as large as the largest age 1.3. All checks on the data for this female indicated that it was not an outlier, and therefore the individual was included in the analysis. For age 1.2 females a weak but significant correlation between egg number and length was observed ($r=0.431$, $P=<0.05$). For age 1.3 the correlation was positive but not significant ($r=0.417$, $P=<0.30$). The mean fecundity of individuals of average length for the two age-types differed significantly. When fecundity of each age type was adjusted to a common length, using analysis of covariance, the difference was not significent ($F=0.653$, d.f.=34). The egg count for age 1.2s which averaged 403.2 mm in PO-HL contained on average 2428 (SD=304) eggs; age 1.3s which averaged 466.4 mm in length averaged 2949 (SD=428) eggs.

The number of eggs carried into Hobiton Lake was calculated from age composition and mean fecundity data for females of different age-types rather than from pooled data. This decision was based on the facts that age 1.2s were approximately 3 times as abundant as 1.3s, and their mean fecundities differred significantly. Fecundity data are lacking for age 2.2s but since sockeye of this age are approximately similar in size to age 1.2s, it was assumed that the egg count for females of these ages would be similar. Also, since age 2.2 females comprised 1.4% of the escapement any errors introduced by this assumption would be small. The calculations indicate that the potential number of eggs carried into the system by females of all ages was 59.4×10^6 (Table 13). Since observations were not made on either pre-spawning mortality for females or egg retention the estimate must be regarded as a maximal mean value.

DISCUSSION AND CONCLUSIONS

Sockeye returning to Hobiton Lake in 1982 experienced fertilized nursery lake conditions as juveniles (1978-1980). The total run, which includes the native catch (26,881) and the estimated escapement (49,439), based on machine counts adjusted for error and by-pass at the weir site, amounted to 76,320 sockeye. Considerable effort was expended in collecting both catch and escapement data and therefore these estimates, while minimal,

are believed close to the actual values. The total run in 1982 is the largest ever recorded and exceeds by approximately 50% those of the early 1950's when commercial fishing was permitted (Fedorenko et al. 1979).

Sockeye appeared first off Hobiton River during early April and were present until late-July when observations ceased. Compared to many sockeye runs in southern British Columbia the Hobiton run is early. During this period the numbers of sockeye entering the fishery or river fluctuated daily but most of the run occurred during late June. On a single day (26 June) 14,337 sockeye or 18.8% of the total run migrated into Hobiton Lake. In general 5-yr-old fish were more prevalent during the early stages of the run and 4-yr-olds during the latter stages; a feature common to many sockeye stocks having multiple age-groups.

The examination of daily changes in the number of upstream sockeye migrants in relation to Hobiton River water levels and temperatures along with native catches and barometric pressures for the general area (observed at Carnation Creek) indicated that cumulatively these parameters accounted for 11.37% of the variability in the escapement. Changes were best predicted by barometric pressure (r^2=11.35%), with the highest correlation being with pressure events 2 days earlier (r=+0.526, p=<0.01). This relationship is most apparent during 23 - 27 June when minimal pressures and maximal escapements for the study period occurred (Fig. 5). The results of these analyses are not conclusive when the intensity of the relationships are considered, but it is worthy of noting that they tend to support Ellis' (1962) observations on upstream migrations of sockeye, which led him to hypothesize that weather changes may act as "releaser" stimuli, and elicit an upstream migratory response.

Continuous hourly counts of sockeye migrants on all but a few days of counter operation provide information on the diel migratory behaviour of sockeye into Hobiton Lake. Approximately 80% of the sockeye migrated during hours of darkness and into daybreak: generally, the numbers of sockeye increased significantly at 2300 h and remained relatively numerous until 0600 h, inclusive. A few sockeye migrated during each hour for the remainder of the daily cycle. This pattern apparently was not altered to any great extent by variable daily fishing effort at the mouth of the Hobiton River.

A comparison of observations on the diel migrations of Hobiton sockeye with those on other stocks reveals some variations in upstream migratory patterns. According to Neave (1943), Ward found sockeye to be most active in the morning and evening hours. The system or stock under study was not specifically indicated. Chapman (1941) observed at Rock Island Dam on the Columbia River from 8 May to 27 October, 1937, from 5-6 AM until dark that of 3 ladders available, sockeye utilizing the outside ladders were most numerous in the early morning, and their numbers decreased through the day. In contrast, sockeye movement up the middle ladder was predominately from 4 to 8 PM. Withler and Aro (1954), counting sockeye at Babine Lake in central British Columbia for 24 hours daily for several consecutive days for 3 periods from 8 August to 15 September, concluded that almost the entire run passed through the fence in daylight hours between dawn and dusk, and the daily peak occurred before or at noon. Ellis (1962), on the basis of standardized 8-hr daily counts starting at dawn, described 3 patterns for sockeye leaving the fishway leading into Great Central Lake on Vancouver Island. One pattern

showed a major wave of sockeye leaving the fishway within a few hours of dawn, occasionally during the first rather than the second hour. A second pattern showed 2 morning peaks, while the third pattern showed a progressive increase in numbers hourly through the afternoon. With the first pattern suggesting some pre-dawn movement Ellis undertook night observations in the following 2 years and learned that as many sockeye migrated into Great Central Lake between dusk and dawn as during the post-dawn movement. Morley (1981) while studying the migrations of adult sockeye into Sproat Lake and Great Central Lakes in 1979 observed that most of the upstream movement into these lakes occurred during daylight hours, that the proportion of night migrants to Great Central Lake exceeded that to Sproat Lake and on occasion was substantial, and that the peak hours of migration to Great Central Lake (0600-1000 h) preceded that to Sproat Lake (0800-1100 h).

The diel pattern observed for sockeye migrating into Hobiton Lake is more similar to Morley's and Ellis' final findings for Great Central Lake sockeye, and is strikingly different from that for Babine and Sproat sockeye. Strict comparisons for other stocks are not possible since it seems counts during dark were not made. Nevertheless, clearly a diel migration pattern exists within the migratory behaviour of sockeye which can differ between stocks. Doubtless the patterns are influenced by factors such as photoperiodism, stream characteristics, and the presence of man-made or natural obstructions to migration.

In this study information on the biological characteristics of the run is based on samples of the native catches made by two gear types which, according to statistical analyses, were free of significant selection for size of sockeye. The extent of the difference between characteristics of the catch and the escapement is not known since the latter was not specifically sampled. However, on several days through the run the catches were relatively small in comparison to the escapement, or non-existent, thus reducing the effect of the fishery on escapement characteristics.

Sockeye of 5 age-types comprised the Hobiton population in 1982. In order of major importance age 1.2 and age 1.3 sockeye were most prominent (72.3 and 23.1%, respectively). Other age-types included 1.1, 2.2 and 2.3, collectively totalling 4.6% of the run. Age 1.3 were significantly larger than 1.2. The change in mean size of sockeye reflects a shift from 1.3s to 1.2s as the dominant age group.

The very large preponderance of returning one-freshwater sockeye conforms with observations on the age composition of most other British Columbia stocks for which there is age information (Foerster 1968). If duration of freshwater residence of some sockeye is influenced by juvenile abundance and food supply, as Krogius (1961) hypothesized for Lake Dalnee sockeye in Kamchatka, it would appear that production of adult Hobiton sockeye is not seriously influenced by competition for food between juveniles belonging to different age-groups. The very large spawning population in 1982 however may provide an opportunity to examine the applicability of Krogius' interesting hypothesis to Hobiton Lake sockeye.

The potential egg deposition into Hobiton Lake for 1982 was estimated to be 59.4×10^6, resulting from 23,484 females. It is known from other examinations that not all eggs carried by a female sockeye are extruded, therefore the number of eggs spawned is actually less by some unknown small amount. Age 1.3 females averaged 2949 eggs compared to 2428 for

age 1.2 females. The greater egg content for age 1.3 females agrees with observations on salmonids in general which show that egg number varies with age. However, fecundity of Hobiton female sockeye of different age but of the same size did not differ significantly. Additionally, average egg content of Hobiton female sockeye suggests relatively low egg production in comparison to other sockeye stocks, according to data provided by Foerster (1968).

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Table 1. Summary of Hobiton sockeye samples, 1982.

Sampling	Sample size	Gear
May 17	28	Gillnet
May 22	50	Gillnet
May 25	43	Gillnet
May 27	38	Gillnet
May 30	32	Gillnet
June 2	27	Gillnet
June 7	100	Gillnet
June 8	100	Drag seine
June 13	100	Drag seine
June 14	89	Gillnet
June 20	100	Drag seine
June 27	89	Gillnet
July 6	100	Drag seine
July 12	100	Drag seine
Total	996	

Table 2. Schedule of simultaneous machine and visual counts for determining machine accuracy, 17 May - 3 July, 1982.

Date		Hour of day																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total hrs.
May	17					X[1]	X																			2
	18														X											1
	20							X	X	X																3
	21						X																			1
	23							X[2]	X																	2
	27						X																			1
	29							X																		1
	31					X																				1
June	12																								X	1
	13	X	X	X	X	X	X	X																		7
	15							X[3]	X																	2
	16																								X	1
	17	X		X	X																					3
	21							X[4]	X																X	3
	22		X	X	X	X	X																			5
	23						X	X																		2
	24						X	X	X	X	X	X														6
	25						X		X	X	X															4
	27						X[5]																			1
July	3						X	X																		2
Total	20	2	2	3	3	4	10	9	6	3	2	1	0	0	1	0	0	0	0	0	0	0	0	0	3	49

[1]Each X=1 h except when otherwise noted.
[2]49 min.
[3]51 min.
[4]37 min.
[5]43 min.

Table 3. Daily statistics on escapement (corrected), native catch, and total stock of Hobiton sockeye, 1982. (IFF= native food fishery).

Date		Escapement (corrected)	Catch (IFF)	Total stock (escapement + catch)	
				Daily	Accumulated
			1400[1]	1400[1]	1400[1]
May	14	23	40	63	1463
	15	20	38	58	1521
	16	20	220	240	1761
	17	84	257	341	2102
	18	264	0	264	2366
	19	227	0	227	2593
	20	129	264	393	2986
	21	29	136	165	3151
	22	63	189	252	3403
	23	802	260	1062	4465
	24	120	287	407	4872
	25	50	138	188	5060
	26	146	45	191	5251
	27	16	309	325	5576
	28	378	80	458	6034
	29	332	293	625	6659
	30	1	266	267	6926
	31	3	318	321	7247
June	1	13	0	13	7260
	2	3	56	59	7319
	3	5	166	171	7490
	4	30	48	78	7568
	5	0	8	8	7576
	6	0	245	245	7821
	7	0	530	530	8351
	8	13	273	286	8637
	9	3	21	24	8661
	10	0	31	31	8692
	11	5	88	93	8785
	12	1436	372	1808	10593
	13	249	1570	1819	12412
	14	32	379	411	12823
	15	686	507	1193	14016
	16	34	0	34	14050
	17	61	0	61	14111
	18	81	38	119	14230
	19	85	0	85	14315
	20	452	1007	1459	15774
	21	1520	980	2500	18274
	22	680	80	760	19034
	23	2411	0	2411	21445
	24	4559	0	4559	26004

Table 3 (cont'd)

Date	Escapement (corrected)	Catch (IFF)	Total stock (escapement + catch) Daily	Accumulated
June 25	1970	137	2107	28111
26	14337	422	14759	42870
27	6272	150	6422	49292
28	550	0	550	49842
29	0	1661	1661	51503
30	26	1471	1497	53000
July 1	53	841	894	53894
2	9	274	283	54177
3	479	650	1129	55306
4	61	1454	1515	56821
5	204	730	934	57755
6	4953	578	5531	63286
7	2381	100	2481	65767
8	205	100	305	66072
9	13	615	628	66700
10	11	630	641	67341
11	2	473	475	67816
12	62	562	624	68440
13	3	755	758	69198
14	10	55	65	69263
15	1979	1538	3517	72780
16	109	1458	1567	74347
17	3	700	703	75050
18	37	0	37	75087
19	96	283	379	75466
20	69	0	69	75535
21	43	127	170	75705
22	246	0	246	75951
23	133	160	293	76244
24	58	18[2]	76	76320
Total	49,439	26,881	76,320	

[1] Sockeye caught April 1 to May 13, 1982.

[2] Sockeye caught July 24 to 26, 1982.

Table 4. Results of linear regression analysis of electronic counts of adult sockeye on visual counts, Hobiton River weir, 1982.

Machine Sensitivity	N	a	b	SE_b	t^1	$p(b \neq 1)$
Low	36	0.00478	0.97097	0.00568	-5.111	<0.001
High	13	0.02577	0.99134	0.00349	-2.481	<0.05

$$^1t = \frac{b - 1}{SE_b}$$

Table 5. Summary of observations on adult sockeye by-pass at Hobiton River weir, 1982.

Date	No. of hours	Visual count	By-pass		Sockeye Density (Fish/hr)	Water level (cm)
			Number	%		
May 23	1.83	279	18	6.5	152.5	20
June 15	1.83	367	7	1.9	225.2	9
June 24	6.00	3780	7	0.2	630.0	6
June 25	4.00	1128	4	0.4	282.0	5
June 27	0.75	504	90	17.8	672.0	7

Table 6. Multiple regression analysis to examine influence of independent variables on escapement, the dependent variable.

Dependent variable	Independent variable	Parameter estimate	R^2
Escapement	Intercept	134057.28	-------
	Barometric pressure	-173.9973*	0.1135
	Catch	-0.2077	0.0000
	Water level	0.0402	0.0000
	Water temperature	-15.1142	0.0002

*Significant at P=0.01

Table 7. Summary of correlation analysis between daily escapement of Hobiton sockeye and barometric pressure (Carnation Creek) on 0 to 4 days prior to escapement observations.

Time lag (days)	No. of observations	Correlation coefficient	P
0	68	0.333	<0.01
1	67	0.345	<0.01
2	66	0.526	<0.01
3	65	0.425	<0.01
4	64	0.375	<0.01

Table 8. Statistics on number of days and adult sockeye migrants for different quartiles of fishing intensity. Percent values are given in parentheses.

Catch level (quartile)	No. of days	No. of sockeye
No fishing	7 (10.7)	7,400 (18.5)
<25	12 (18.5)	25,203 (63.1)
25-50	6 (9.2)	4,778 (11.9)
51-75	12 (18.5)	1,638 (4.1)
>75	28 (43.1)	974 (2.4)
Total	65 (100.0)	39,993 (100.0)

Table 9. Mean and cumulative percent of diel sockeye migration, by hour, Hobiton Lake, 1982.

Hr	Mean%	Cumulative %	S.E.
1	9.83	9.83	1.67
2	10.78	20.61	1.84
3	9.16	29.77	1.45
4	6.77	36.54	1.13
5	9.63	46.17	1.67
6	11.02	57.18	2.24
7	5.12	62.31	1.57
8	1.09	63.39	0.41
9	1.26	64.66	0.70
10	1.20	65.86	0.74
11	0.30	66.16	0.13
12	0.61	66.78	0.24
13	0.93	67.71	0.50
14	0.37	68.08	0.15
15	1.97	70.05	1.25
16	0.68	70.73	0.40
17	0.72	71.45	0.44
18	1.46	72.91	0.70
19	0.51	73.42	0.22
20	0.34	73.76	0.14
21	0.67	74.43	0.41
22	2.93	77.36	1.05
23	12.34	89.70	2.79
24	10.31	100.01	2.33
Number of days		65	
Number of fish		39993	

Table 10. Temporal variation in age* and sex composition of Hobiton sockeye salmon, 1982. (GN=gillnet, SN=drag seine).

Sampling date	Repres. period	Gear	Catch + Escap.		Abundance by age and sex													
					1.1		1.2		1.3		2.2		2.3		Total			
					M	F	M	F	M	F	M	F	M	F	M	F	M+F	%F
May 17	To May 20	GN	2986	No	0	0	4	8	8	7	1	0	0	0	13	15	28	53.6
				%			0.55	1.10	1.10	0.97	0.14				1.79	2.07	3.86	
May 22	May 21-23	GN	1479	No	0	0	15	13	8	9	0	0	0	0	23	22	45	48.9
				%	0.51		0.64	0.56	0.34	0.39					0.98	0.95	1.93	
May 25	May 24-26	GN	786	No	0	0	6	9	5	21	1	0	0	0	12	30	42	71.4
				%			0.15	0.22	0.13	0.52	0.02				0.30	0.74	1.04	
May 27	May 27-28	GN	783	No	0	0	15	9	4	9	0	0	0	0	19	18	37	48.6
				%			0.42	0.25	0.11	0.20					0.53	0.50	1.03	
May 30	May 29-31	GN	1213	No	0	0	8	3	10	10	0	1	0	0	18	14	32	43.8
				%			0.35	0.15	0.50	0.50		0.05			0.85	0.70	1.55	
June 2	June 1-5	GN	3720	No	0	0	8	7	10	2	0	0	0	0	18	9	27	33.3
				%			0.13	0.11	0.16	0.03					0.29	0.14	0.43	
June 7	June 6-7	GN	775	No	0	0	33	34	10	18	0	3	0	0	43	55	98	56.1
				%			0.34	0.35	0.10	0.19		0.03			0.44	0.57	1.01	
June 8	June 8-10	SN	341	No	0	0	43	34	8	8	1	2	0	0	52	44	96	45.8
				%			0.20	0.16	0.04	0.04	0.01	0.01			0.25	0.21	0.46	
June 12	June 11-13	SN	3720	No	0	0	48	35	10	4	0	1	1	0	59	40	99	40.4
				%			2.36	1.72	0.49	0.20		0.04	0.04		2.89	1.96	4.85	
June 14	June 14-17	GN	1699	No	0	0	46	14	11	14	0	1	1	0	58	29	87	33.3
				%			1.21	0.37	0.29	0.37		0.03	0.03		1.53	0.77	2.30	

Table 10 (cont'd)

Sampling date	Repres. period	Gear	Catch + Escap.		Abundance by age and sex													
					1.1		1.2		1.3		2.2		2.3		Total			
					M	F	M	F	M	F	M	F	M	F	M	F	M+F	%F
June 20	June 18-23	SN	7334	No	0	0	33	44	6	12	1	3	0	0	40	59	99	59.6
				%			3.20	4.27	0.58	1.16	0.10	0.29			3.88	5.72	9.60	
June 27	June 24-July 1	GN	32449	No	0	0	40	19	13	10	4	1	0	0	57	30	87	34.5
				%			19.59	9.30	6.37	4.90	1.96	0.49			27.92	14.69	42.61	
July 6	July 2-9	SN	12806	No	3	0	31	50	8	4	1	2	0	0	43	56	99	56.6
				%	0.51		5.25	8.45	1.35	0.68	0.17	0.34			7.28	9.47	16.75	
July 12	July 10+	SN	9620	No	2	0	26	58	3	7	0	1	0	0	31	66	97	68.0
				%	0.26		3.37	7.52	0.39	0.91		0.13			4.02	8.56	12.58	
Total			76320	No	5	0	356	337	114	135	9	15	2	0	486	487	973	50.1
				%	0.77		37.76	34.53	11.95	11.11	2.40	1.41	0.07		52.95	47.05	100.00	

*Age is designated according to the European system. The first digit represents the number of annuli formed during freshwater residence; the second digit, the number of annuli formed during ocean residence.

Table 11. Incidence of "jack" sockeye salmon at Hobiton River weir, 1982.

	No. of adults (A)	No. of "jacks" (J)	$\frac{J}{A + J} \times 100$
May 23	262	17	6.1
June 13	186	12	4.0
15	362	10	2.7
16	4	0	0.0
17	14	0	0.0
22	233	0	0.0
23	608	15	2.4
24	3861	13	0.3
25	1201	4	0.3
27	510	0	0.0
28	550	13	2.3
July 3	230	0	0.0
Total	8021	84	1.0

Table 12. Statistics on age 1.2 and age 1.3 female Hobiton sockeye used in fecundity analysis, 1982. Values in parentheses are standard errors.

Age	Sample size	Mean length (mm)	Mean fecundity	Regression statistics		
				a	b	r
1.2	25	403.2 (5.2)	2428 (61)	1.219	0.830	0.431*
1.3	11	466.4 (5.1)	2949 (129)	-1.274	1.776	0.417n.s.

Post orbital-hypural length

* $P<0.05$

n.s. = not significant

Table 13. Estimation of potential egg deposition for Hobiton sockeye in 1982.

Age	Estimated number	Mean fecundity	No. of eggs
1.2	17,087	2428	41,487,236
1.3	5,498	2949	16,213,602
2.2	697	2428	1,692,316
Total			59,393,154

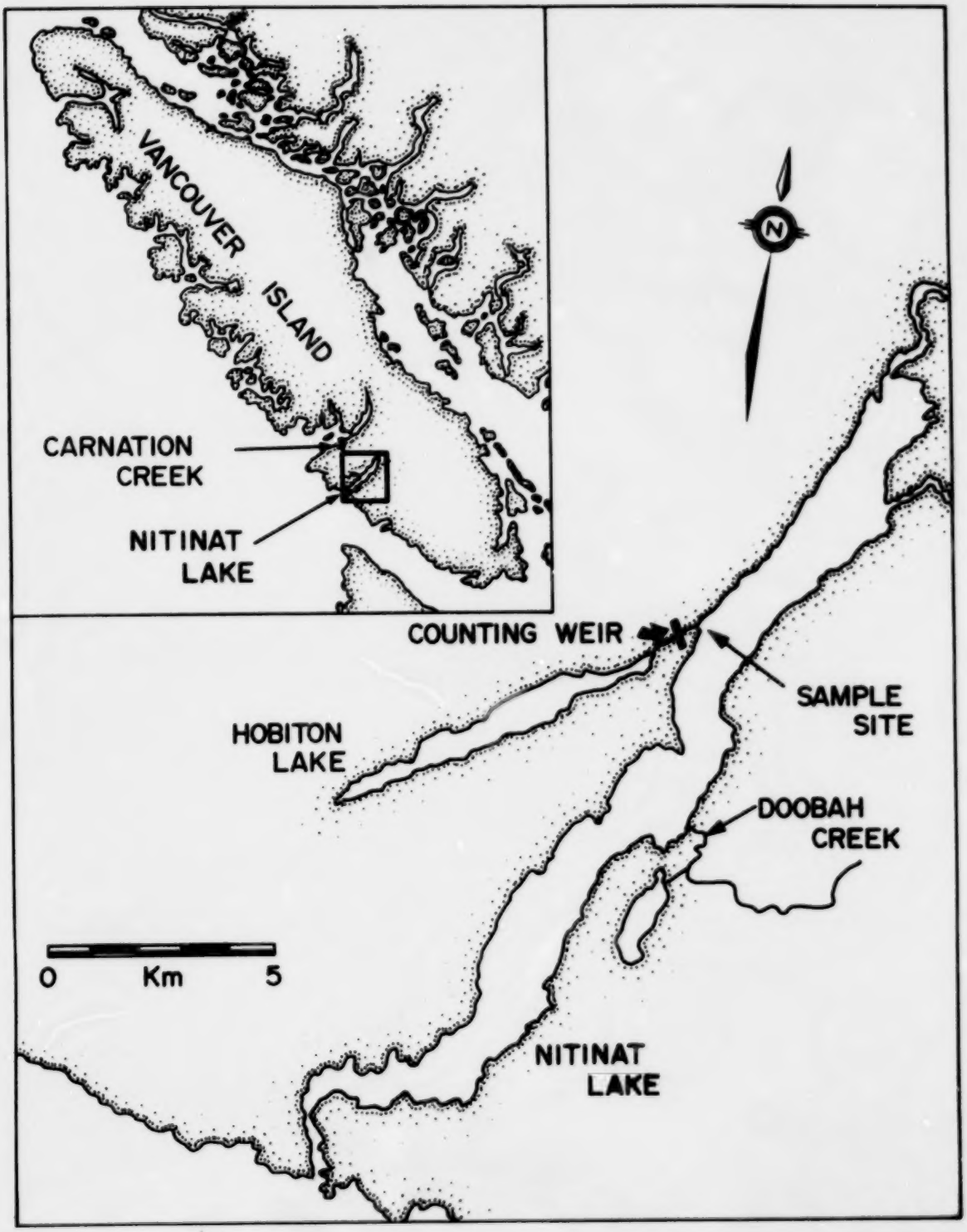


Fig. 1. Hobiton Lake study area, 1982.

Fig. 2. Adult counting weir on Hobiton River, 1982, showing downstream view from either bank. Note wires (top frame) leading from immersed tunnels to electronic counter housed in shelter (bottom frame).

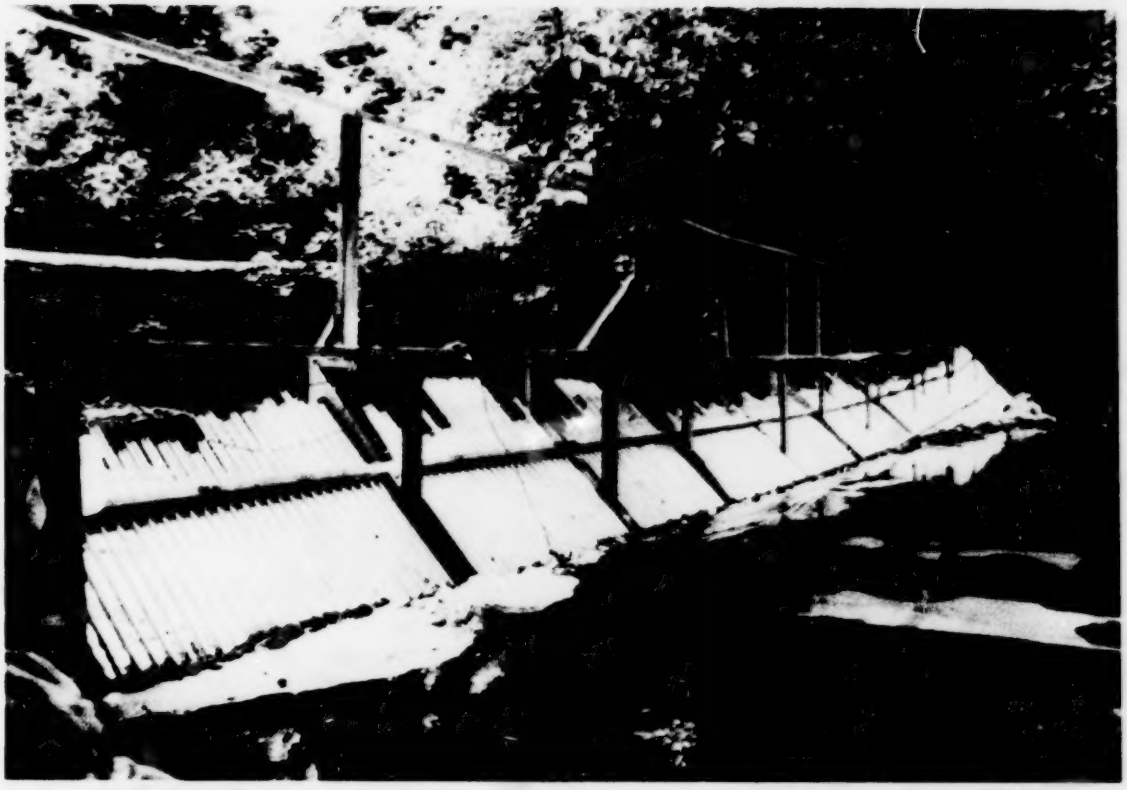


Fig. 3. Daily fluctuations in catch, escapement and total stock for Hobiton sockeye, 1982.

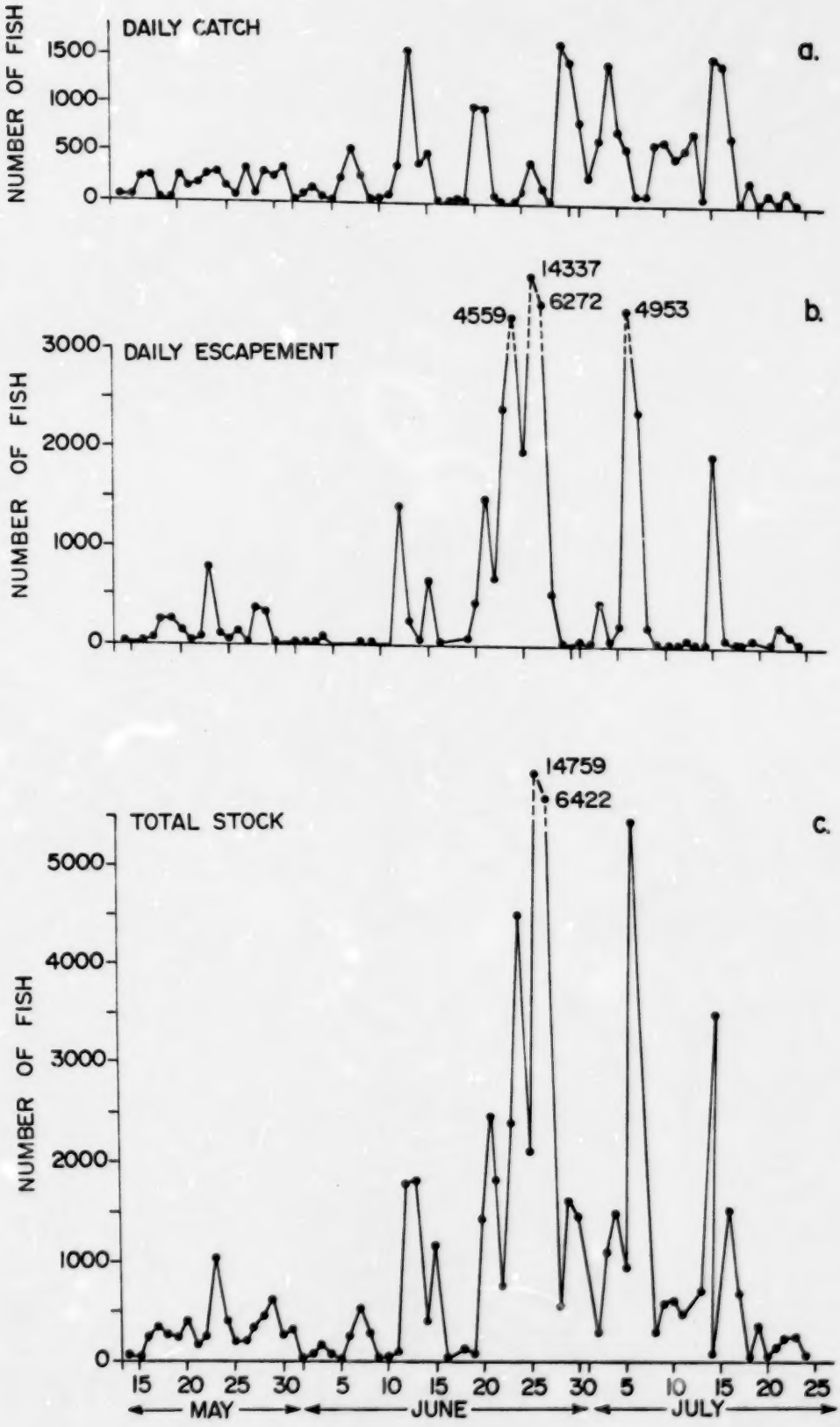
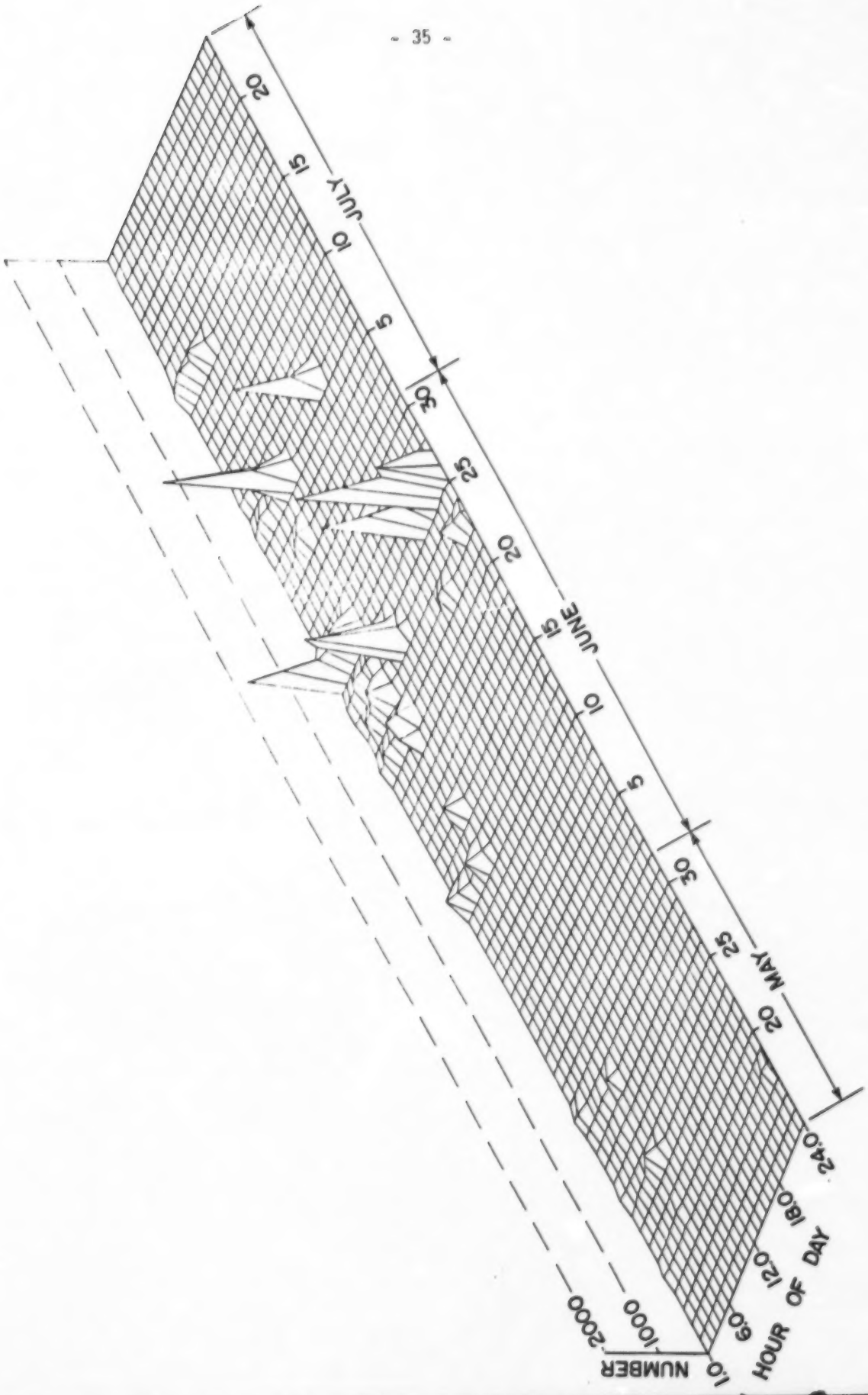

DAILY CATCH
a.
NUMBER OF FISH
1500
1000
500
0
14337
6272
4559
4953
b.
DAILY ESCAPEMENT
3000
2000
1000
0
14759
6422
TOTAL STOCK
c.
5000
4000
3000
2000
1000
0
15 20 25 30 5 10 15 20 25 30 5 10 15 20 25
MAY
JUNE
JULY

Fig. 4. Estimated number of sockeye migrating hourly through the Hobiton River weir, 14 May to 24 July, 1982.


MAY
20
25
30
JUNE
5
10
15
20
25
30
JULY
5
10
15
20
HOUR OF DAY
0.0
6.0
12.0
18.0
24.0
NUMBER
0
1000
2000

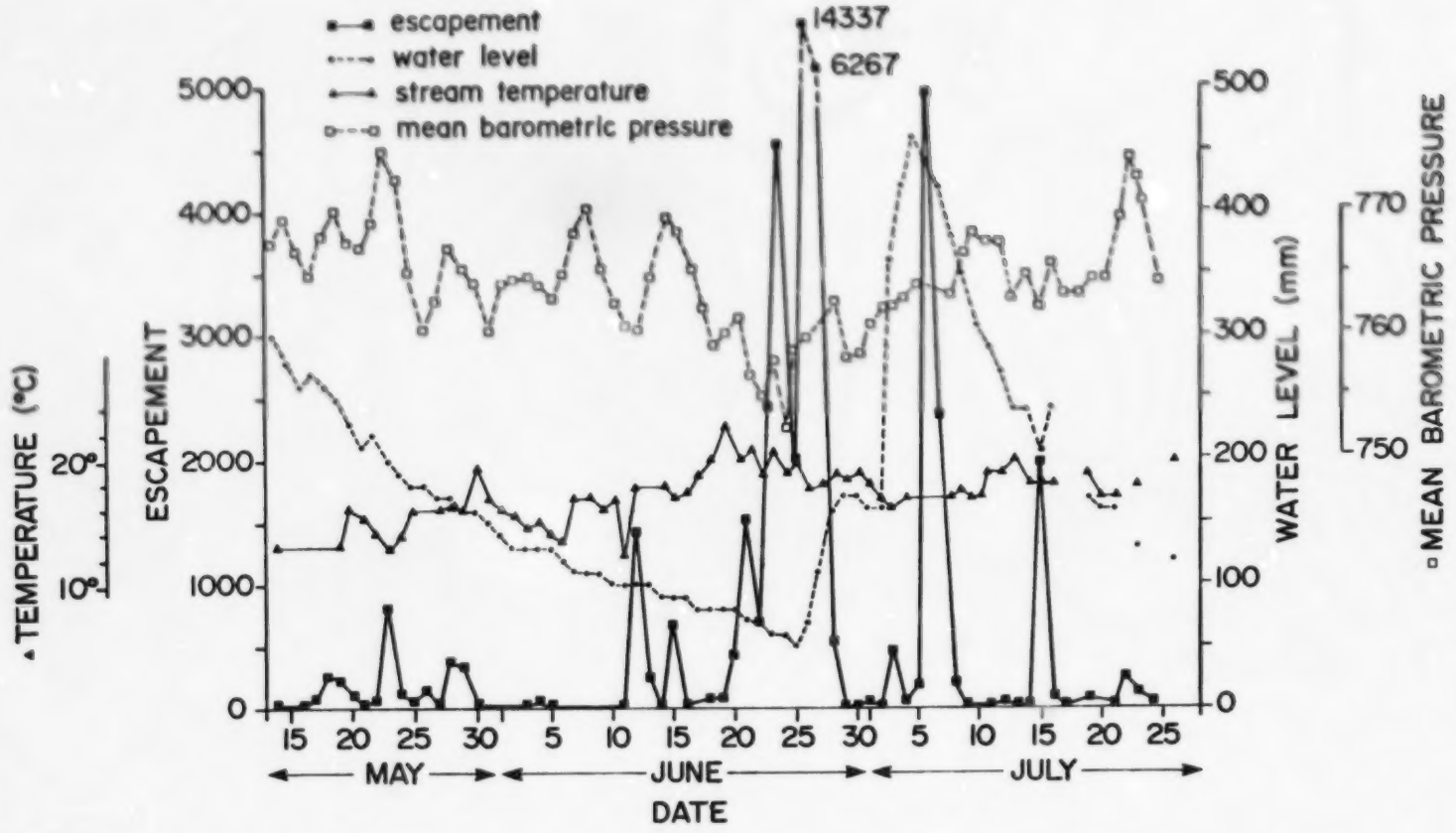
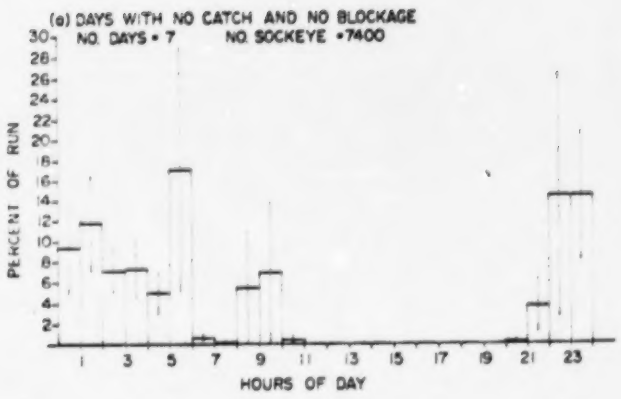
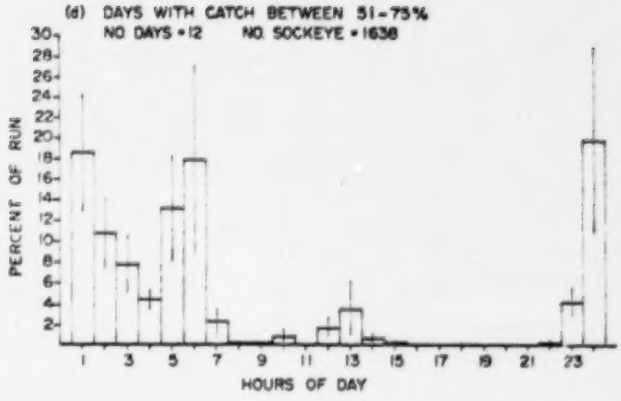
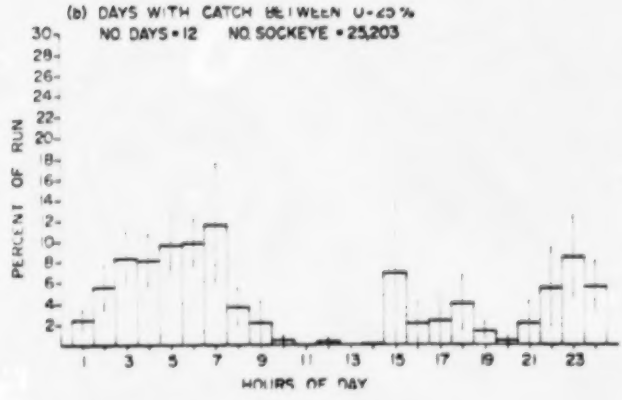


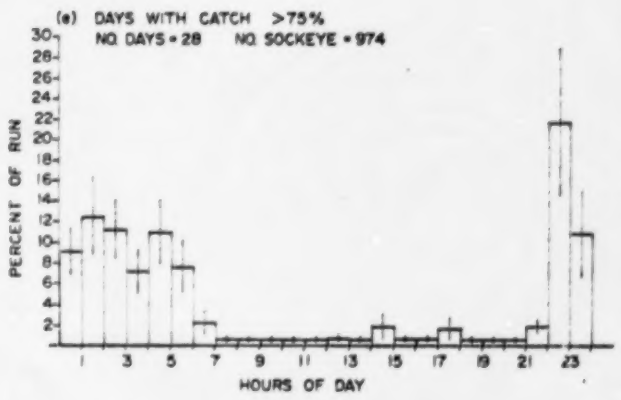
Fig. 5. Daily changes in escapement of sockeye into Hobiton Lake in relation to river water levels and stream temperatures at Hobiton River, and mean barometric pressures at Carnation Creek, 14 May - 27 July, 1982.

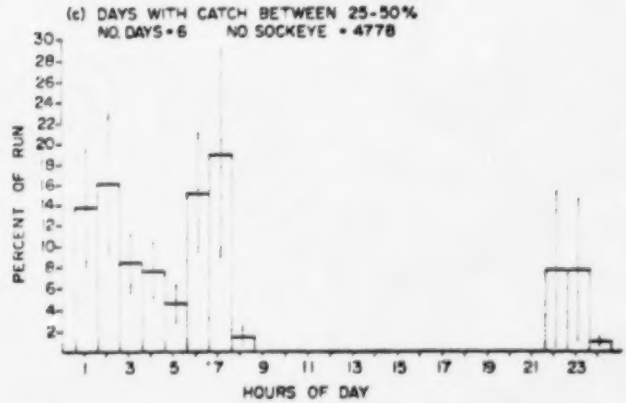
Fig. 6. Diel migration pattern for Hobiton sockeye, 1982. Panel (a) represents pattern developed for escapements for 7 individual 24-hr periods unimpeded by the native fishery or river blockage. Panels (b) to (e) represent diel patterns for sets of days when the catch equalled increasing quartiles of the total daily run. Vertical lines = mean ($\pm$2 SE).


(a) DAYS WITH NO CATCH AND NO BLOCKAGE
NO. DAYS = 7 NO. SOCKEYE = 7400
PERCENT OF RUN
HOURS OF DAY


(d) DAYS WITH CATCH BETWEEN 51-75%
NO. DAYS = 12 NO. SOCKEYE = 1638
PERCENT OF RUN
HOURS OF DAY


(b) DAYS WITH CATCH BETWEEN 0-25%
NO. DAYS = 12 NO. SOCKEYE = 25,203
PERCENT OF RUN
HOURS OF DAY


(e) DAYS WITH CATCH >75%
NO. DAYS = 28 NO. SOCKEYE = 974
PERCENT OF RUN
HOURS OF DAY


(c) DAYS WITH CATCH BETWEEN 25-50%
NO. DAYS = 6 NO. SOCKEYE = 4778
PERCENT OF RUN
HOURS OF DAY

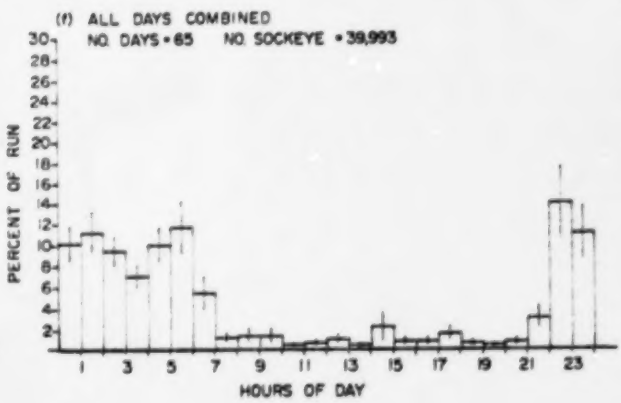
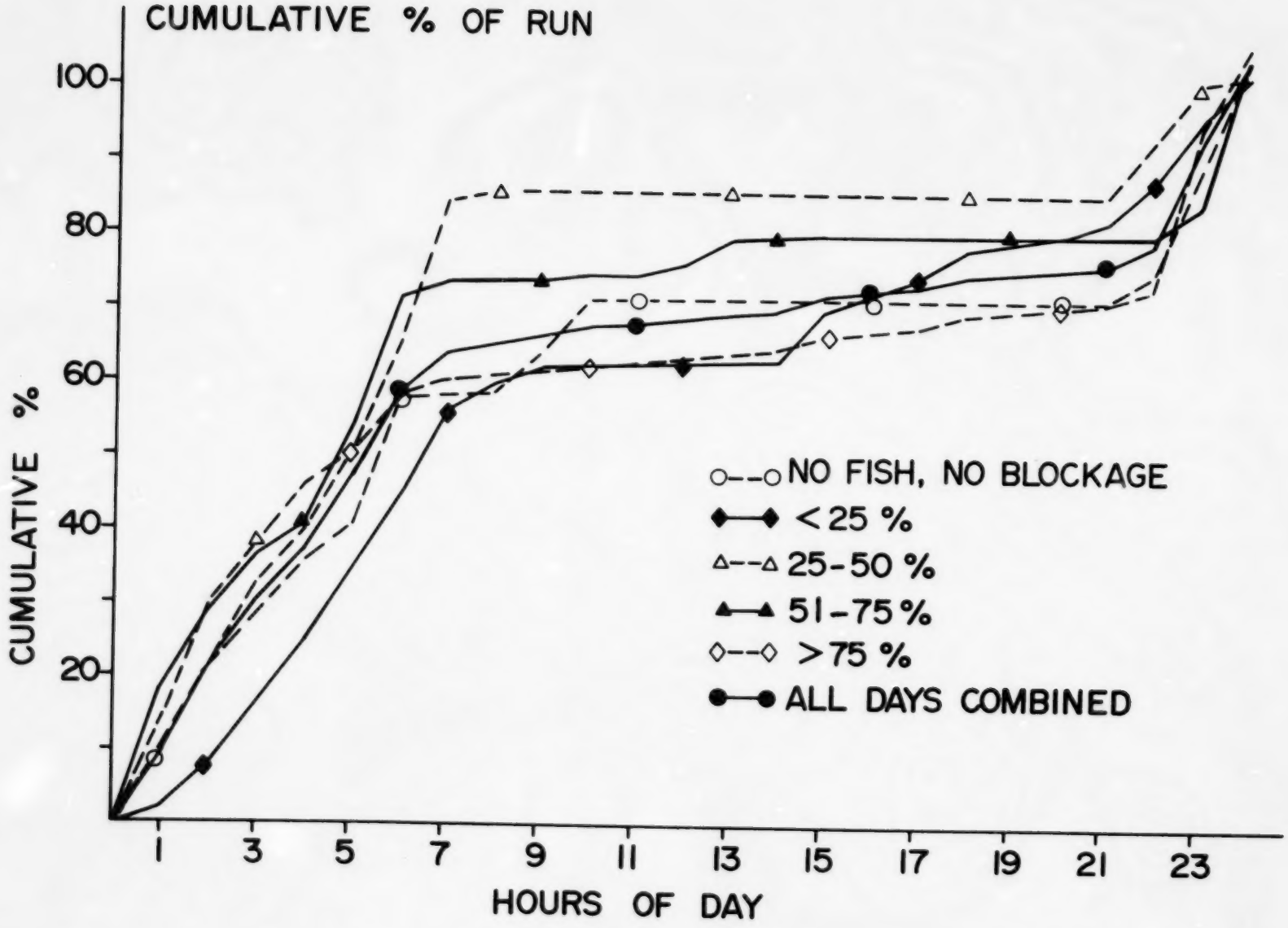

(f) ALL DAYS COMBINED
NO. DAYS = 65 NO. SOCKEYE = 39,993
PERCENT OF RUN
HOURS OF DAY

Fig. 7. Cumulative percent of daily migration of Hobiton sockeye for different fishing levels.


CUMULATIVE % OF RUN
100
80
60
40
20
CUMULATIVE %
1
3
5
7
9
11
13
15
17
19
21
23
HOURS OF DAY
NO FISH, NO BLOCKAGE
< 25 %
25-50 %
51-75 %
> 75 %
ALL DAYS COMBINED

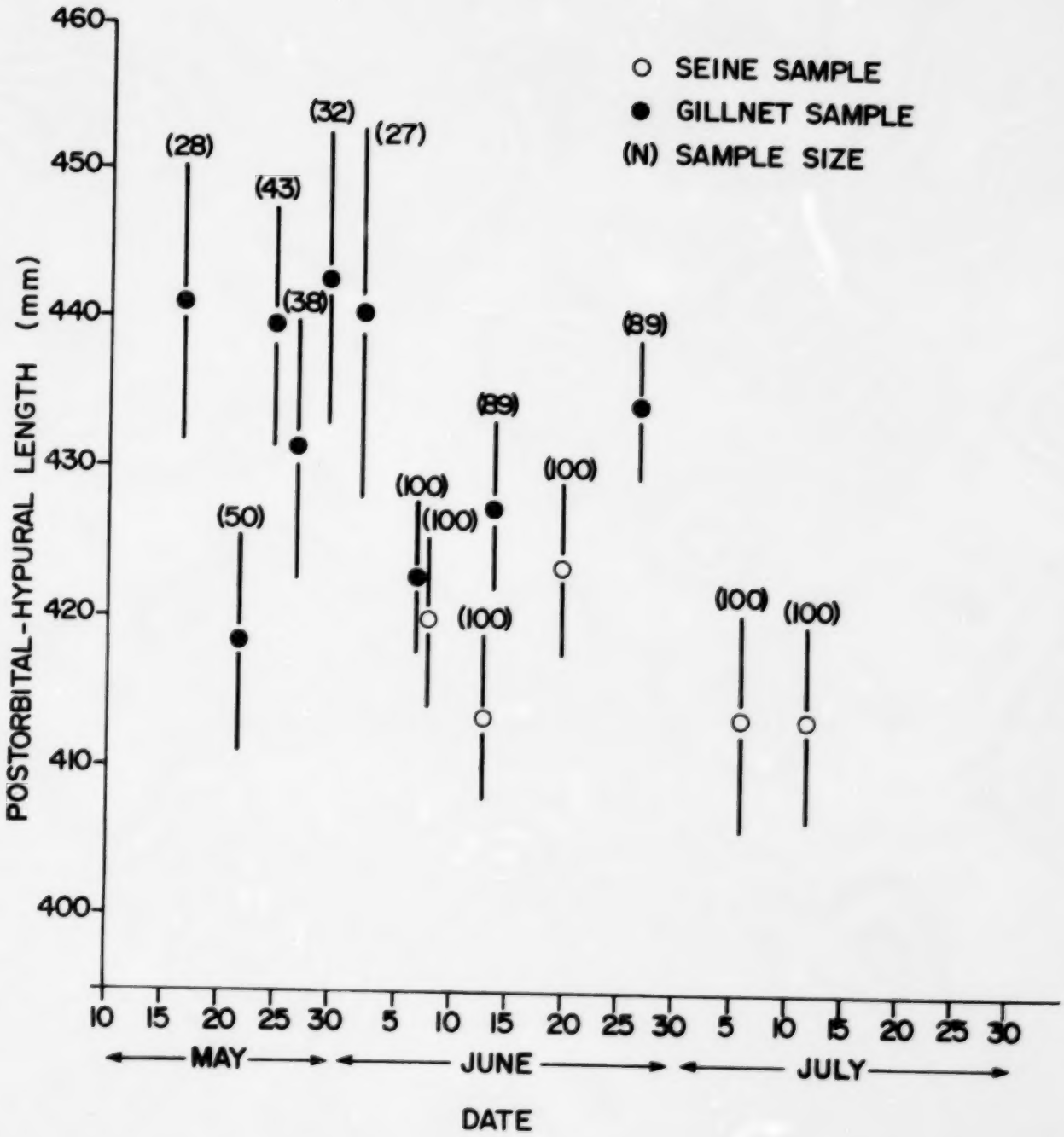


Fig. 8. Temporal changes in mean (±2 SE) postorbital-hypural lengths of Hobiton sockeye caught by gillnets and drag seiners operated by native fishery, 1982.

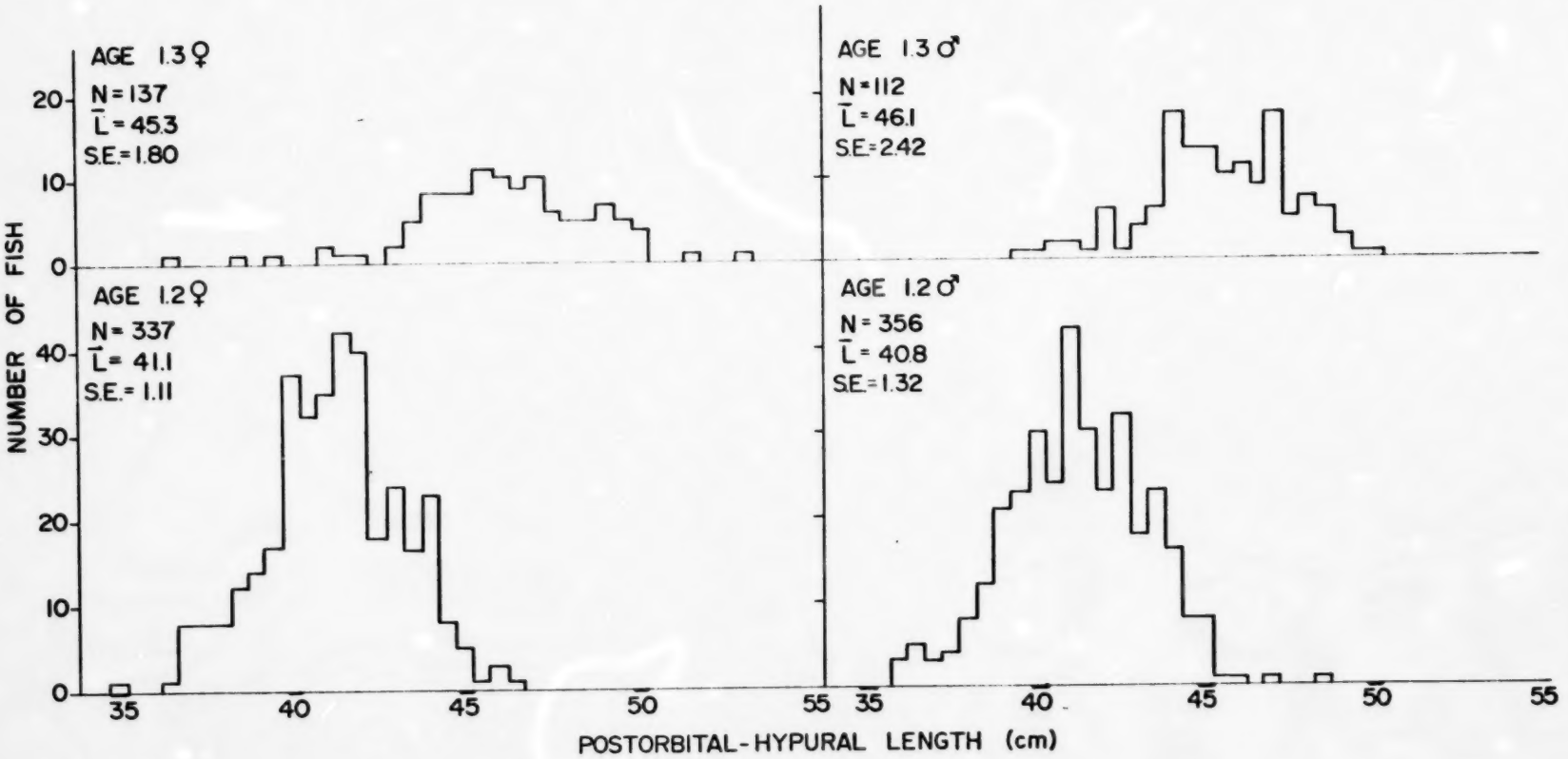


Fig. 9. Postorbital-hypural length distribution of age 1.2 and age 1.3 male and female Hobiton sockeye, 1982.

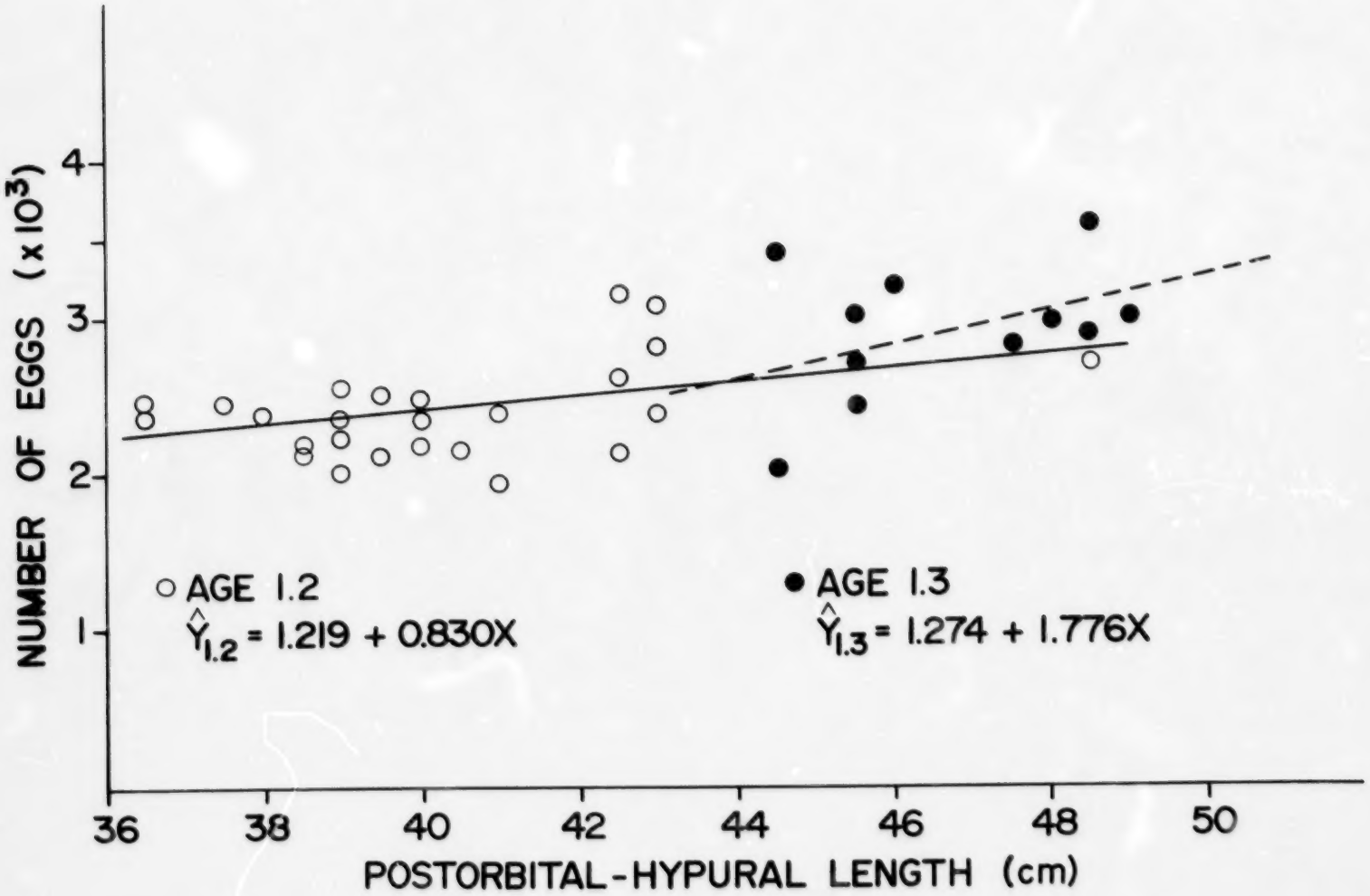


Fig. 10. Regressions of egg numbers on postorbital-hypural lengths (cm) of age 1.2 and age 1.3 female Hobiton sockeye, 1982.

Appendix table 1. Summary of fishing by-laws for Nitinaht Band, 1982.

NOTICE

UNDER THE NITINAHT BAND FISHING BYLAW

THE FOLLOWING REGULATIONS SHALL BE IN EFFECT UNTIL FURTHER

NOTICE FROM MAY 20TH 1982 ONWARD FOR SOCKEYE SALMON

(1) Food Fishing will be allowed between the Hour of 00:01 Sunday and 12:00 P.M. Tuesday of each week until June 29th/82 (Saturday Midnight to Tuesday Midnight).

(2) ALL COMMERCIAL FISHERY is hereby Prohibited for Sockeye on the Hobitan and Sales of Fish is Prohibited.

(3) Sundays are designated as the Community Food Fishing Day during which time Fishery by Drag Seine will be Allowed. During times when Drag Seine is being used all, Fishing by other gear type is Prohibited.

(4) Maxiumum Length of Gill Net is Hereby Established not to Exceed 50 (fifty) Fathoms in Length.

(5) Anyone taking Fish from Nitinaht Waters is Required to Report the Number of Fish taken to either the Band Fisheries Conservation Officer or to the Band Office before the Next Weeks Fishery Opening.

(6) All Fishing Within Hobitan Creek (River) is hereby Prohibited.

(7) No Person who is Not a Member of Nitinaht Band Shall be Permitted to Fish in Nitinaht Waters.

NITINAHT BAND COUNCIL

Appendix table 2. Simultaneous visual and machine counts of adult sockeye, Hobiton River, 17 May - 3 July, 1982.

Obs. no.	Date	Dur.	Time	Vis.	Auto
			Low Sensitivity		
1	5/17	60	0400/0500	3	3
2	5/17	60	0500/0600	1	1
3	5/18	60	1300/1400	1	1
4	5/20	60	0600/0700	23	16
5	5/20	60	0700/0800	1	1
6	5/20	60	0800/0900	1	1
7	5/21	60	0500/0600	1	1
8	5/23	49	0611/0700	190	178
9	5/23	60	0700/0800	89	85
10	5/27	60	0500/0600	3	3
11	5/29	60	0600/0700	7	7
12	5/31	60	0400/0500	1	1
13	6/12	60	2300/2400	1	1
14	6/13	60	0000/0100	16	16
15	6/13	60	0100/0200	66	64
16	6/13	60	0200/0300	39	35
17	6/13	60	0300/0400	4	4
18	6/13	60	0400/0500	1	1
19	6/13	60	0500/0600	71	65
20	6/13	60	0600/0700	1	0
21	6/15	51	0609/0700	320	272
22	6/15	60	0700/0800	47	40
23	6/16	60	2300/2400	4	4
24	6/17	60	0000/0100	12	12
25	6/17	60	0200/0300	1	1
26	6/17	60	0300/0400	1	1
27	6/21	37	0623/0700	63	54
28	6/21	60	0700/0800	25	21
29	6/21	60	2300/2400	1	1
30	6/22	60	0100/0200	14	14
31	6/22	60	0200/0300	31	26
32	6/22	60	0300/0400	31	29
33	6/22	60	0400/0500	103	91
34	6/22	60	0500/0600	54	45
35	6/23	60	0500/0600	542	455
36	6/23	60	0600/0700	66	55

Appendix table 2 (cont'd)

Obs. no.	Date	Dur.	Time	Vis.	Auto
			High Sensitivity		
37	6/24	60	0500/0600	180	180
38	6/24	60	0600/0700	80	79
39	6/24	60	0700/0800	54	54
40	6/24	60	0800/0900	1715	1639
41	6/24	60	0900/1000	1601	1580
42	6/24	60	1000/1100	150	149
43	6/25	60	0500/0600	245	233
44	6/25	60	0700/0800	277	264
45	6/25	60	0800/0900	490	476
46	6/25	60	0900/1000	116	116
47	6/27	43	0517/0600	504	481
48	7/03	60	0500/0600	240	236
49	7/03	60	0600/0700	9	9

Appendix table 3. Unadjusted hourly machine counts of adult sockeye salmon passing through Hobiton River weir, 1982.

YR/MO/DY	0000 0100	0100 0200	0200 0300	0300 0400	0400 0500	0500 0600	0600 0700	0700 0800	0800 0900	0900 1000	1000 1100	1100 1200	1200 1300	1300 1400	1400 1500	1500 1600	1600 1700	1700 1800	1800 1900	1900 2000	2000 2100	2100 2200	2200 2300	2300 2400
82/05/14	0	0	0	0	0	0	0	0	0	2	0	2	7	0	0	0	0	0	0	0	0	0	1	10
82/05/15	7	2	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	3	2
82/05/16	2	7	2	4	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/05/17	1	1	0	0	3	1	0	0	0	0	0	0	3	0	26	2	2	24	0	0	0	10	4	1
82/05/18	3	6	7	11	18	25	2	0	0	0	0	11	0	1	0	0	0	0	0	0	0	3	89	62
82/05/19	58	24	19	19	-	44	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	2	1
82/05/20	0	0	0	4	27	56	16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
82/05/21	0	3	6	2	-	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	3
82/05/22	2	1	2	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	45
82/05/23	12	12	46	48	63	128	236	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	22
82/05/24	61	16	10	8	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
82/05/25	18	13	6	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/05/26	1	7	21	42	38	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
82/05/27	1	3	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
82/05/28	35	37	33	44	54	14	118	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/05/29	97	126	19	19	17	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
82/05/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
82/05/31	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
82/06/01	0	1	4	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
82/06/02	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/03	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/04	6	1	0	3	16	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1
82/06/08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/06/09	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/06/10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/06/11	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/06/12	121	345	221	56	69	335	81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix table 3 (cont'd)

YR/MO/DY	0000 0100	0100 0200	0200 0300	0300 0400	0400 0500	0500 0600	0600 0700	0700 0800	0800 0900	0900 1000	1000 1100	1100 1200	1200 1300	1300 1400	1400 1500	1500 1600	1600 1700	1700 1800	1800 1900	1900 2000	2000 2100	2100 2200	2200 2300	2300 2400
82/06/13	14	63	35	3	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	4
82/06/14	2	0	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	2
82/06/15	0	0	1	3	0	175	346	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/16	0	3	1	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
82/06/17	12	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	0
82/06/18	3	3	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	30	1
82/06/19	0	0	2	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	27	6
82/06/20	3	8	0	1	23	314	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	37	0
82/06/21	96	91	201	150	62	391	289	21	0	0	0	0	0	0	0	0	164	171	39	2	0	0	1	0
82/06/22	0	14	26	29	91	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	384	16	0
82/06/23	10	31	202	213	299	455	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	216	156
82/06/24	106	68	4	3	52	180	79	54	1639	2035	136	0	0	0	0	0	0	0	0	0	0	0	16	11
82/06/25	94	126	119	250	157	174	0	264	476	115	0	0	0	0	0	0	0	0	0	0	0	30	82	17
82/06/26	0	1	3	1	1	0	0	0	0	0	0	0	0	0	39	15	0	2111	1191	579	2958	1991	1285	1520
82/06/27	1969	1217	542	480	58	620	0	0	0	0	0	0	0	0	0	0	0	59	84	-	-	-	-	371
82/06/28	241	72	8	15	62	152	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82/06/29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	17
82/06/30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	0
82/07/01	17	10	3	0	7	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
82/07/02	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
82/07/03	4	14	17	28	159	236	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
82/07/04	1	0	0	1	18	32	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
82/07/05	50	47	49	19	27	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
82/07/06	61	108	191	95	103	686	2655	826	45	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/07/07	1	1	0	1	0	0	0	0	0	0	0	0	0	21	1694	576	3	0	0	0	0	0	9	7
82/07/08	58	51	15	19	0	11	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
82/07/09	2	1	2	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
82/07/10	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
82/07/11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/07/12	1	23	28	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix table 3 (cont'd)

YR/MO/DY	0000 0100	0100 0200	0200 0300	0300 0400	0400 0500	0500 0600	0600 0700	0700 0800	0800 0900	0900 1000	1000 1100	1100 1200	1200 1300	1300 1400	1400 1500	1500 1600	1600 1700	1700 1800	1800 1900	1900 2000	2000 2100	2100 2200	2200 2300	2300 2400
82/07/13	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
82/07/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	9
82/07/15	156	306	350	347	251	405	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
82/07/16	37	25	31	14	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/07/17	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
82/07/18	4	11	6	8	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	32
82/07/19	18	33	22	2	7	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	27
82/07/20	1	9	7	7	4	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	59
82/07/21	3	2	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
82/07/22	69	66	22	18	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
82/07/23	41	32	39	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
82/07/24	20	18	6	3	2	0	0	0	0	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix table 4. Adjusted hourly machine counts of adult sockeye salmon passing through Hobiton River weir, 1982.

YR/MO/DY	0000 0100	0100 0200	0200 0300	0300 0400	0400 0500	0500 0600	0600 0700	0700 0800	0800 0900	0900 1000	1000 1100	1100 1200	1200 1300	1300 1400	1400 1500	1500 1600	1600 1700	1700 1800	1800 1900	1900 2000	2000 2100	2100 2200	2200 2300	2300 2400
82/05/14	0	0	0	0	0	0	0	0	0	2	0	2	7	0	0	0	0	0	0	0	0	0	1	11
82/05/15	7	2	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	3	2
82/05/16	2	7	2	4	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/05/17	1	1	0	0	3	1	0	0	0	0	0	0	3	0	29	2	2	26	0	0	0	11	4	1
82/05/18	3	6	7	12	20	27	2	0	0	0	0	12	0	1	0	0	0	0	0	0	0	3	101	70
82/05/19	65	26	21	21	35	49	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	2	1
82/05/20	0	0	0	4	30	63	17	1	0	0	0	0	0	8	0	0	0	0	0	0	0	0	3	3
82/05/21	0	3	6	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10	3
82/05/22	2	1	2	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	50
82/05/23	13	13	51	54	71	147	277	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	24
82/05/24	69	17	11	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
82/05/25	20	14	6	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/05/26	1	7	23	47	42	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
82/05/27	1	3	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
82/05/28	39	41	36	49	61	15	135	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
82/05/29	111	145	21	21	18	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
82/05/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
82/05/31	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
82/06/01	0	1	4	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
82/06/02	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
82/06/03	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/04	6	1	0	3	17	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	1
82/06/08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/06/09	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/06/11	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82/06/12	139	409	258	63	78	397	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix table 4 (cont'd)

YR/MO/DY	0000 0100	0100 0200	0200 0300	0300 0400	0400 0500	0500 0600	0600 0700	0700 0800	0800 0900	0900 1000	1000 1100	1100 1200	1200 1300	1300 1400	1400 1500	1500 1600	1600 1700	1700 1800	1800 1900	1900 2000	2000 2100	2100 2200	2200 2300	2300 2400
82/06/13	15	71	39	3	0	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	4
82/06/14	2	0	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	2
82/06/15	0	0	1	3	0	203	410	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/16	0	3	1	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
82/06/17	13	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0
82/06/18	3	3	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	33	1
82/06/19	0	0	2	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	30	6
82/06/20	3	8	0	1	25	371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	41	0
82/06/21	109	104	234	173	70	465	341	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
82/06/22	0	15	29	32	104	50	0	0	0	0	0	0	0	0	0	0	190	198	43	2	0	0	17	0
82/06/23	11	34	236	249	353	544	62	0	0	0	0	0	0	0	0	0	0	0	0	0	32	457	252	181
82/06/24	108	69	4	3	52	184	80	54	1704	2119	138	0	0	0	0	0	0	0	0	0	0	0	16	11
82/06/25	95	128	121	256	160	177	0	270	489	117	0	0	0	0	0	0	0	0	0	0	0	30	83	17
82/06/26	0	1	3	1	1	0	0	0	0	0	0	0	0	0	39	15	0	2199	1235	596	3091	2073	1333	1579
82/06/27	1969	1217	542	480	58	620	0	0	0	0	0	0	0	0	0	0	0	59	84	0	0	0	0	371
82/06/28	241	72	8	15	62	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/06/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	17
82/07/01	17	10	3	0	7	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
82/07/02	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
82/07/03	4	14	17	28	162	241	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
82/07/04	1	0	0	1	18	32	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
82/07/05	50	47	49	19	27	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
82/07/06	62	110	195	96	105	708	2771	853	45	6	0	0	0	0	0	0	0	0	0	0	0	0	1	1
82/07/07	1	1	0	1	0	0	0	0	0	0	0	0	0	0	21	1761	593	3	0	0	0	0	0	0
82/07/08	59	51	15	19	0	11	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	7
82/07/09	2	1	2	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
82/07/10	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
82/07/11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
82/07/12	1	23	28	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix table 4 (cont'd)

YR/MO/DY	0000 0100	0100 0200	0200 0300	0300 0400	0400 0500	0500 0600	0600 0700	0700 0800	0800 0900	0900 1000	1000 1100	1100 1200	1200 1300	1300 1400	1400 1500	1500 1600	1600 1700	1700 1800	1800 1900	1900 2000	2000 2100	2100 2200	2200 2300	2300 2400
82/07/13	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/07/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	9
82/07/15	159	313	359	356	257	416	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	3
82/07/16	37	25	31	14	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/07/17	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82/07/18	4	11	6	8	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
82/07/19	18	33	22	2	7	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
82/07/20	1	9	7	7	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	32
82/07/21	3	2	0	4	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	4	27
82/07/22	70	67	22	18	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	60
82/07/23	41	32	39	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
82/07/24	20	18	6	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0